Space Weather Technical Forecast

Issued on Sunday, 19 June 2022 at 13:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Daily Chance of an isolated M-class flare. Chance of Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with background X-ray flux recorded at GOES16 steady on the boundary between B and C class. Occasional small X-ray flares were generally well-spread between many of the front-side sunspots, of which there were nine numbered regions and one unnumbered. The largest flare of the period was a C4.9 at 18/2105UTC from AR3031, which ended the 24 hours as a Dao/Beta, having shown a reduction in area and shrinking trailing spots in the period.
Most of the current roster of sunspots are small and simple, with one Axx groups, two Hsx and three Bxo. Of the remainder, the most noteworthy were AR3030 in the northwestern quadrant, which remained as a Dai/Beta; and AR3038 in the northeast, which also developed into a Dai/Beta region. AR3030 showed a spreading and amalgamating trend in its trailing group, while AR3038 showed proliferation of its intermediate spots, although neither produced particularly marked flare activity.
A large filament in the northwestern quadrant showed some movement early in the period, as did a smaller feature in the northeast to end the 24 hours, with the later producing a small CME, which is forecast to pass to the north and east of Earth, and thus there were no Earth directed CMEs observed during the period.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, was relatively static in the past 24 hours and is presumed to remain characteristic of a continuing fast wind, most likely from CH90/+ or perhaps CH92/+.
The solar wind speed was elevated or strong, between 550 km/s and 630 km/s. Density was near-flat about 10ppcc. The IMF was within normal background levels between 4 and 7 nT, and with a north-south variation of +/-5nT. Finally, the phi angle remained mostly positive (away from the sun), but briefly switching negative at times. The net result of the above solar wind measures was Quiet to Active (Kp 2-4), but the interval 18/2100-2400 UTC was initially recorded as G1/Minor Storm.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured by GOES16 remained at background levels through the period. Electron flux (greater than 2MeV) was generally at Moderate to High levels in the period, with a peak of 1380pfu observed at GOES16 at 18/1615UTC. The corresponding 24-hour integrated electron fluence showed a rising trend, with a value of 5.52e7 integrated pfu observed at 19/1200UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low, with a daily chance of an isolated M-class flare and slight chance of an X-flare.

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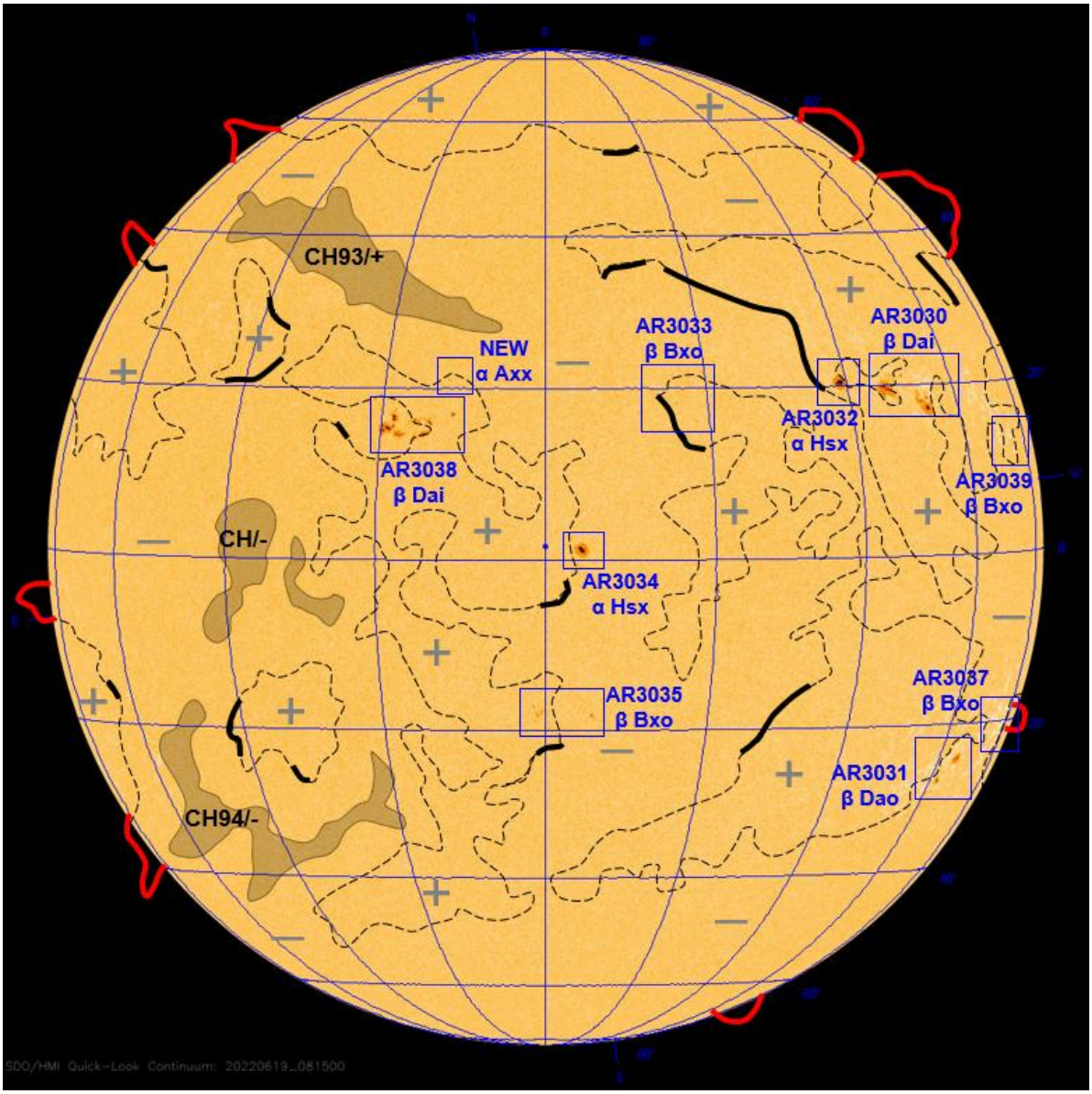
Solar Wind / Geomagnetic Activity: No CMEs feature in the forecast. Elevated solar winds being experienced at present, are expected to decline to ambient levels by day 3 (21st). Geomagnetic activity should therefore peak on day 1 (19th), with a slight chance of a G1 interval, else gradually decreasing to mainly Quiet conditions by day 3 (21st).

Energetic Particles / Solar Radiation: High energy electron flux (greater than 2 MeV) may show further slight day-on-day increases in response to the current fast wind, probably becoming marginal for 24-hour integrated Active fluence, but most likely falling just short given the now slowing rate of increase.
High energy proton flux (greater than 10 MeV) is expected to be at Background levels during the period, but with a daily Slight Chance of an S1 or greater event occurring, mainly due to the presence of AR3030, AR3031 and AR3038.

Figure 1. Solar Analysis Valid 19/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in the forecast.

Solar winds are currently elevated, with Earth most likely connected to the high speed from CH90/+ or CH92/+, although the onset(s) were likely clouded by the 13 June CME's arrival. No further coronal hole high speed streams are forecast during the period, and current STEREO A MAG and PLASTIC data, while patchy, suggests solar winds should decline to ambient levels by day 3 (21st). Quiet to Unsettled geomagnetic activity should therefore become largely Quiet by day 3 (21st). There is chance of Active intervals and a slight chance of a G1/Minor Storm interval on day 1 (19th), whilst solar winds are at their strongest.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Radio Blackouts - X-Ray Flares:

There are currently ten sunspot regions on the solar disc, although they are well-spread and the vast majority are either unipolar or simple dipoles. The sheer number of groups as well as the three or four more complex entities make for relatively high raw probabilities of X-ray flares, however this is still not being borne out, and the background X-ray trace recorded at GOES16 remains rather flat.
STEREO A EUVI195 imagery suggests there is a degree of survival of plage or sunspots in the (up to four) returning regions due in the period. These may go some way to compensating for the loss of AR3031 and AR3030 later in the period, however this is conjectural until they present for analysis over the eastern limb.
All considered, solar activity is likely to continue at Low levels, with further C-class flares. There is a daily Chance of an M-class flare (reduced relative to raw values) and a slight chance of an X-class flare, reducing on day 4 (22nd) as the regions mentioned above transit to the far side.

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X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	25	20
Very Active	R3 to R5 X Class	No	5	5	5	2

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at background levels and is expected to remain at this level through the period. However, there is a slight chance of an S1 or greater event in the period. This risk averages to around 5% a day due to the well spread nature of the larger regions on the disc, and any departing regions should be reinforced by the westward transit of the remaining spots.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES16 has shown an increase in the magnitude of its diurnal oscillation in response to the current fast wind near 600km/s. This has led to a rise in 24-hour integrated fluence, however this trend has recently slowed. Increased geomagnetic activity in the past 24-hour period may further dent counts at GEO for a time, however it is still felt that any recovery ought to fall just short of Active fluence levels, as per previous rotation.
MOSWOC REFM is currently felt to be offering good guidance inside the first 24 hours, however the forecast beyond this is considered overly-reactive to the fast wind and will probably be a full decade lower near the Active rather than Very Active threshold.

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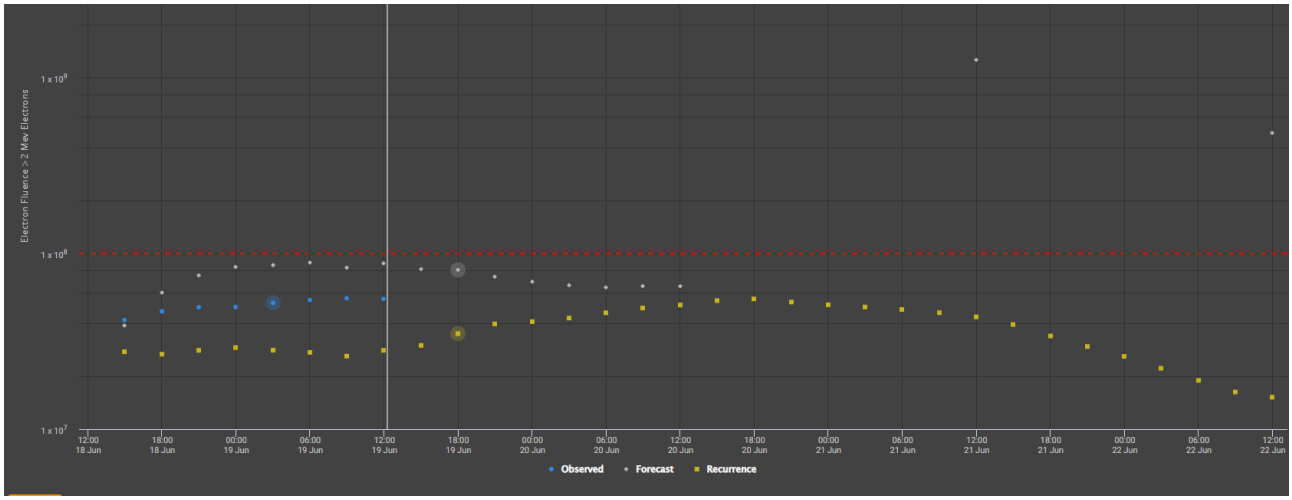
GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	30	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: Observed GOES-16 Electron fluence, with REFM and persistence data.



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